

Occurrence of *Lumpenus lampetiformis* on the North Coast of Scotland; with Notes on its Habits, Food, and the Ground it frequents. By GEORGE SIM. (Communicated by Dr. FRANCIS DAY, F.L.S.)

[Read 17th June, 1886.]

*LUMPENUS LAMPETRIFORMIS*, the subject of the following remarks, is a northern form of the tribe Blenniidæ. It was described by Collett, a naturalist who accompanied the Norwegian North-Atlantic Expedition, 1876-78. According to this writer, *Lumpenus* appears to be a rather common fish in most localities along the Norwegian coast. As to its geographical distribution, I cannot do better than quote from a paper on the species under notice by Dr. F. Day. He says:—"Up to the present time (June 1884) this species has been recorded from the coast of Greenland and Iceland. It is common off Spitzbergen and on the shores of North-western Europe as far south as the Cattegat. In the north its range extends certainly as high as 80°." Collett says, "The southern limit of its range is probably Bohuslan, in Sweden, one or two individuals having been obtained off Gothenburg, 58° N." This latter writer's remarks on the species are of a general description; and nothing is said as to the nature of the ground *Lumpenus* frequents, the other living organisms that accompany it in its haunts, nor does he say a word as to the food of this interesting species. To these points the following notes more particularly refer.

The discovery of this species as British is of very recent date, the first example having been brought to light by Prof. M<sup>c</sup>Intosh of St. Andrews in May 1884. This one he obtained fifteen miles off St. Abbs Head, while engaged in a series of observations on trawling, undertaken at the instance of the Scottish Fishery Board. Prof. M<sup>c</sup>Intosh sent the specimen for examination to Dr. Day, who has described and given an excellent figure of it in the 'Proceedings' of the Zoological Society of London.

The second specimen found in Britain I obtained on an Aberdeen trawl-vessel on April 14th, 1885; and being quite unknown to me, and not having at that time seen Dr. Day's description of Prof. M<sup>c</sup>Intosh's specimen, I made a sketch of the one now

under notice and sent it to Dr. Day, who at once recognized it as *L. lampetiformis*, although differing very much in the form of the caudal fin from Prof. McIntosh's specimen, the difference being that McIntosh's specimen had the outer caudal rays elongated beyond the central ones for nearly half the length of the caudal fin; while in my specimen the central ray was longest, the others decreasing in length on each side of it, thus giving the tail a lanceolate form, or, as Collett says, an "acuminate form." Strangely enough, all my specimens have the same form of tail. On receipt of this information, the fish was forwarded to Cheltenham for examination by Dr. Day; and in due course I received a note from him stating that the specimen was a female *Lumpenus*, while that of Prof. McIntosh was an old male; and this he considered would explain the difference in the form of the tail.

The occurrence of this specimen Dr. Day recorded in 'Nature' for July 9th, 1885. Thus stood the matter until March 25th, 1886, on which date a second example came to my hand, and on March 31st eleven more; while from April 1st till May 31st fifty-seven specimens have made up my findings. This will indicate pretty clearly that the species is not so rare upon the coast of Britain as we were at first disposed to think.

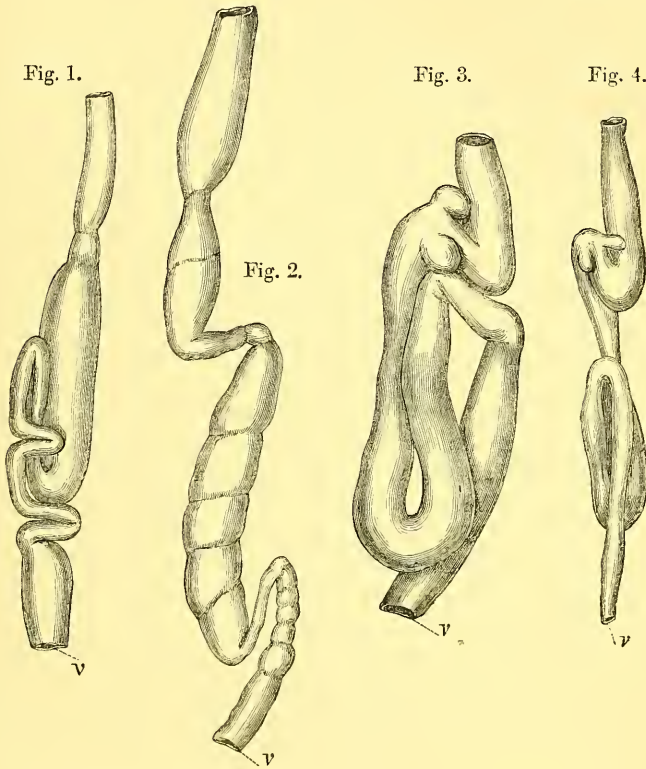
In general appearance, *Lumpenus* approaches very nearly to that of our common Blennies, *Centronotus gunnellus* and *Zoarees viviparus*, to which it is closely allied; but on close examination it is seen to differ from them considerably, both in external colouring, fin arrangement, and internal organization. To give a minute description of the external appearance of *Lumpenus* is quite unnecessary, as this has been done by Dr. Day in the article already mentioned, as well as by Collett. My purpose, then, is merely to note the points where the three species differ and where they agree, in so far as I have been able to observe the same. Comparing *Lumpenus* with the Spotted Gunnel (*Centronotus gunnellus*), we find in both the spinous dorsal fin, the number of rays in *Centronotus* being 76 to 78, while in *Lumpenus* the number is 72 to 74; the latter number I have only once observed. In *Centronotus* the ventral fins have disappeared, and are represented by two short stout spines; in *Lumpenus*, however, these fins are comparatively well developed, each having one spinous ray and four soft ones. In the matter

of dentition, *Centronotus* has a single row of conical teeth in both jaws, becoming shorter as they approach the angle of the mouth; sometimes there exist a few irregularly set teeth in the upper jaw in addition to the regular row; several strong teeth on the vomer; four patches, two on each side, of irregularly set upper pharyngeal teeth, and two long patches below, also set irregularly. On the other hand, *Lumpenus* is furnished in the upper jaw with numerous irregularly set teeth, the outer ones being conical, the others sharp-pointed, and all decreasing in length as they approach the angle of the mouth. The lower jaw is set with one, sometimes two rows of long incurved, rather sharp teeth, not of uniform length, and all becoming shorter laterally; none on the vomer or tongue. There are two irregularly set patches of upper pharyngeal teeth, each point of which is finely tinged with yellow; and four lower pharyngeals forming two sides of a triangle set confusedly, and without the yellow colour of the upper ones. In the number of vertebræ, *Centronotus* outnumbers *Lumpenus* by 3, the latter having 80 and the former 83.

But the greatest departure which *Centronotus* makes from *Lumpenus* is in the form of the stomach and intestines. As will be seen by the accompanying figures, the intestines of *Centronotus* in some cases show little change in the stomach from the intestines proper; that is, there is no very distinct line of demarcation between them; presenting more or less the form of a simple tube and are devoid of cæca. I have said in some cases. This will be best understood by referring to figs. 1 and 2, both of which represent the intestines of *Centronotus*, both drawn from specimens caught by myself and while the intestines lay *in situ*. This is a change in the internal arrangement of a species I have never before observed carried to such a length, although the individuals of no species have the intestines formed or laid exactly alike. The result of my investigation goes to show that fig. 1, or something much like it, is the most usual arrangement to be met with in *Centronotus gunnellus*. On the other hand, *Lumpenus* has what may be called a properly developed stomach, marked off from the intestines by its two cæcal appendages, and the intestinal track forms several convolutions in its course.

With reference to the cæca in *Lumpenus*, I find they differ much in length in different individuals, even although these individuals are of themselves the same size. In some examples

these appendages are about  $\frac{1}{4}$  inch long, while in others they are barely half that length. Is this difference in the stomach and intestines due to, or is this arrangement necessary to meet, the



Figs. 1 and 2. Stomach and intestines of *Centronotus gunnellus*.  
 Fig. 3. Stomach and intestines of *Zoarces viviparus*.  
 Fig. 4. Stomach and intestines of *Lumpenus lampetriformis*.

different conditions of food and habitat sustained by *Lumpenus* in comparison with its allies ?

Turning to the Viviparous Blenny (*Zoarces viviparus*), as compared with *Lumpenus*, the difference in some points is greater than in the case of the latter and *Centronotus* ; while in other particulars *Lumpenus* and *Zoarces* approach much more nearly to one another. In external form, *Lumpenus* is long and somewhat

cylindrical, becoming compressed towards the caudal extremity, while in *Zoarces* the body is compressed along its whole length. Its dorsal fin has soft rays, 83 in number, after which are a few spinous rays; and the ventrals are well developed, having all the rays soft. In dentition *Zoarces* differs from *Lumpenus* in having a double row of teeth in both jaws, merging into one row, and becoming less in size as they approach the angle of the mouth. Six rows of upper pharyngeal teeth, viz. three on each side, the first a single row, the other two double. Lower pharyngeal teeth set in a double row which form a triangle; no teeth on the vomer or tongue. The number of its vertebræ is 116, whereas in *Lumpenus*, as already pointed out, these bones only number 80. In the case of the internal viscera, there is a great similarity in the two species under notice as compared with that of *Centronotus*. But the point wherein lies the greatest difference between these closely allied species is the fact of *Zoarces* bringing forth its young alive\*.

*Lumpenus* is not viviparous. As to its time of spawning I cannot speak with certainty; at the end of April some of those I found had the roe pretty well advanced, much more so than was the melt of the males caught at the same time. Then, again, on May 20th I found one specimen measuring only  $1\frac{3}{4}$  inch. Assuming that the species breeds only once a year, and taking into account the fact that those caught in April had spawn fully halfway advanced towards maturity, we may safely conclude that the spawning takes place in July or August, and that my  $1\frac{3}{4}$ -inch specimen was one of last year's young. On being boiled, the vertebræ of *Zoarces* become a fine deep-green colour, those of *Lumpenus* remain white.

It will thus be seen that although *Lumpenus* has something in its composition similar to both our common species; it is at the same time so widely different that no doubt need be entertained as to its being a distinct and well-marked species, nor any difficulty experienced in recognizing it from its congeners.

\* On April 22, 1886, I had two specimens of this fish—one of them with its young, of which there were thirty, almost ready for expulsion, each measuring  $2\frac{1}{4}$  inches; and in addition to these there were thirty-one more, evidently the young of the former year, which had not been given birth to; they were all firmly fixed together and in a hard wasted condition, yet capable of being separated individually. Why they had not been born at their proper time is a mystery difficult of solution.

The only locality where *Lumpenus* has yet been found on the north-east of Scotland is in a deep hollow in the Moray Firth, which runs almost parallel to the land, and extends from opposite the village of Roseharty on the Aberdeenshire coast to near TARBETNESS in Rosshire, where it bifurcates, the



SKETCH-MAP OF MORAY FIRTH AND REGION AROUND, indicating the position of the "Witch Ground."

other point running in the direction of the Cromarty Firth. Reference to the sketch-map above will show the "lie" of this ground. This hollow slopes gradually from the shore, but rises abruptly on the north-east or seaward side. It is from six to ten miles off shore, and 35 to 110 fathoms deep,

the greatest depth being at the Aberdeenshire end. This track is known to the trawl-fishers as the "Witch Ground." The reason for this name being given to it is because along a portion of the area, principally off "Covesea Scars," enormous numbers of *Pleuronectes cynoglossus*, the Pole or Craig Fluke, which these trawlers know as the Witch-Sole, are taken: hence the "Witch Ground." The bottom of this hollow is in some places composed of grey muddy sand, while in other parts it is principally covered with mossy matter. Concerning this latter material, considerable difficulty was experienced by me in coming to any definite conclusion regarding it. The question being, How came peat to be in such a locality? Was it matter washed by some river into this ground, or how came it to be there? It came first under my notice whilst examining the stomachs of the Witch-Sole. In many cases the stomach and intestines of this species contain portions of this peat which had been taken in along with the creatures upon which it feeds. However, during the storms which occurred in the month of January last immense sheets of peat were cast on our beach, which shows that at some long past age a forest of birch, hazel, and other trees had flourished, as also marshes filled with *Sphagnum*, *Polytrichum*, and other fresh-water-loving plants, where now swells the mighty waves of the North Sea. The remains of these sylvan beauties we now find composing the large masses of peat to which reference has been made. It is amongst this soft peaty ooze that our fossorial little friend *Lampenus* loves to dwell, and amongst and on the surface of the same material where it finds its varied food, and where, in its turn, it becomes the food of its ever-watchful neighbours *Pleuronectes cynoglossus*.

The other living organisms that have come under my notice from the "Witch Ground" are, first, a few of the common Zoophyta, viz. *Tubularia indivisa*, *Sertularia abietina*, *Thuiaria thuia*, known in the locality as the bottle-brush weed; the "seapen" (*Pennatula phosphorea*), *Alcyonium digitatum*, locally known as "dead men's fingers," and the common *Flustra* also occur, but the last-named is perhaps only washed from the hard ground on the east of this great hollow.

Threading their way through the above-mentioned forms are those beautiful Ophiuroids *Amphiura Chiajii*, *A. filiformis*, *Ophiocnida brachiata*, *Ophioglypha albida*, *O. lacertosa*, and

*Ophiothrix pentaphyllum*. Here and there very sparingly distributed is also to be found that link which joins the present to the past—our elegant British Crinoid, *Antedon rosacea*.

From the depths of this vast aquarium we also sometimes obtain a specimen of that fine, but most repulsively odoured Starfish, *Stichaster roseus*, accompanied occasionally by *Palmipes membranaceus*.

Here also is that form which the late Prof. Forbes calls one of the rarest and most beautiful of our native Starfish, *Hippasteria plana*; beautiful it unquestionably is; but in this long valley it is by no means rare, dozens are sometimes brought up at one drag of the net. Accompanying it, but in very much fewer numbers, is its exquisitely coloured little brother, *Porania pulvillus*. And yet again, along this great expanse of mud, sand, and peat, live *Astropecten irregularis* and *Luidia Savignyi*, the latter a form more troublesome and tantalizing in its habits than any of our Starfish with which the lover of Nature may come in contact. Hundreds of this fine form are brought up both by trawl and line, but only to fall in pieces on coming to the surface, or, as Forbes says, “in a minute he proceeds to dissolve his corporation.”

Of the Echinoidea which frequent this ground, we have *Echinocyamus pusillus*, *Spatangus purpureus*, *Brissopsis lyrifera*, and *Echinocardium cordatum*, while in each suitable resting-place are specimens of *Priapulius caudatus*, a favourite food of the “Witch-Sole.” *Aphrodita aculeata* is also present in abundance.

The Crustacea to be met with along these grounds are numerous and highly interesting. Heading the list comes *Cancer pagurus*, *Lithodes maia*, *Nephrops norvegicus*, *Corystes cassivelaunus*, *Calocaris Macandreae* (the latter is eaten in enormous numbers by the Witch-Sole), *Galathea squamifera*, *G. dispersa*, and *G. Andrewsii*, *Pagurus Bernhardus*, *P. Thompsoni*, and *P. Prideauxi* (always accompanied by its humbler friend *Adamsia palliata*), *Portunus holsatus*, *P. pusillus*, and *P. depurator*, *Crangon vulgaris*, *C. bispinosus*, and *C. trispinosus*, *Hippolyte spinus*, *Callinassa subterranea*, *Pandalus annulicornis*, various species of the genus *Diastylus*, accompanied by their kindred form *Eudora truncatula*, and several of the Mysidæ literally swarm. These are all the higher Stalk-eyed Crustacea; but in addition to the above list there is another stalk-eyed form, of which I have taken several specimens



from the stomach of the Witch-Sole ; it is not, so far as I am aware, described in any British work, and it therefore remains unnamed.

In Sessile-eyed Crustacea of the orders Amphipoda and Isopoda the ground is very rich. As to the identity of *Anonyx denticulata*, *Hypera galba*, and *Arcturus longicornis* there is no doubt ; but many others are in my possession which are not yet identified. *Pycnogonum littorale* is abundant.

Turning to Molluscan life, the list is a fairly large one. First of all, on account of its numbers, delicate structure, and fine sculpturing, comes that lovely little form *Philine scabra*, followed by *Nucula nitida*, *Solen pellucidus*, *Tellina fabula*, *Scrobicularia prismatica*, *Psammobia Ferroensis*, *Donax anatinus*, *Mactra stultorum* and *M. solida*, *Pleurotoma turricula*, *Tornatella fasciata*, *Dentalium entale*, *Venus linctæ*, and *Aporrhais pes-pellicani* ; while *Pholas crispata* finds a congenial home in the easily perforated peat. Many other shells have been seen, but not living ; so that in all likelihood they have been merely washed by the waves to the "Witch Ground" after the death of their occupants.

Food-fishes other than the Witch-Sole are scarce and of bad quality along this ground ; and, according to the trawl-fishers, many of the Cod and Haddock caught there have some wound upon them, or are otherwise lean and out of condition. For this reason some of the fishermen give this hollow the name of the "Fish Hospital," because they think the sickly fish have come in so that they might heal their sores and recruit their strength.

Such, then, is an outline, necessarily very imperfect, of the living organisms which frequent the ground which *Lumpenus* haunts and in which it burrows. For the latter statement there is perhaps no absolute proof ; but that it is fossorial I am strongly inclined to think, from the fact of its always being caught by the trawl ground-rope. In the narrow openings between the outer coils of this rope it is generally firmly jammed, invariably accompanied by masses of sand, mud, and peat, of which, as already stated, the bottom is composed.

It would seem that the ground-rope, in cutting through the uneven surface, comes upon *Lumpenus* in its retreat, and fixes the creature in its folds before there is any chance of escape. Were the fish a free-swimmer only, the chances are very slight for such a slender form to be caught at all.

The next question to which attention had to be directed was, upon what does *Lumpenus* feed? Although many of the fish obtained were so much injured as to be rendered useless as specimens, fortunately the stomach of each had escaped mutilation, and therefore the contents were at my disposal; another favourable circumstance was that each stomach was well filled. Microscopical examination of the contents of their stomachs reveals the fact that the food of *Lumpenus* is almost a purely crustacean one, confined in a very large measure to the Entomostraca and Copepoda; but in addition to these, I have found in several numerous immature specimens of the two genera *Dia-stylus* and *Edora*, minute bivalve mollusks, annelids, and several very small fish-scales, minute starfish of the genus *Amphiura*, a crustacean evidently parasitic (this I infer from the fact of its being furnished on each foot with a strong long circular claw or hook), very small forms of *Priapulius caudatus*, and a number of brown pear-shaped objects quite unknown to me; also sessile-eyed crustacea (Amphipoda).

As already stated, the Entomostraca and Copepoda largely predominate, the species in greatest number being what seems to me *Dactylopus tisboides* of Brady. Along with it is another form of the same genus, and very like *D. tisboides* in every way except that the last abdominal segment terminates in a long sharp cylindrical telson, at each side of which, and somewhat under it, are two short terminal segments from which issue several setæ of unequal length. Another creature presenting itself in some abundance is in general form somewhat like *Idotea parallela* of Bate and Westwood; but differs from that species, first, in being very small, and in having its body divided into thirteen segments instead of nine as in *Idotea*, and also in having the first pair of feet very powerful, terminating in equally strong didactyle hands. Its name remains unknown to me.

Then follow two species of the genus *Cythere* of Baird; they occur in about equal numbers; one seems to me to be *Cythere minna*; but if Baird's figure and description are correct, those I have cannot belong to that species. *C. minna*, according to Baird, is "obtusely rounded on the anterior extremity;" my specimens are equally acute at both ends. Can it be a species not described by the author just quoted? The second form answers to the figure and description of *Cythere pellucida* of Baird.

In naming these latter creatures specifically, I have done so with considerable hesitation, as it must be confessed my knowledge of these groups is much too limited to warrant my speaking with any great degree of certainty.

Thus ends my notes on *Lumpenus lampetiformis*; and I trust its habits and history have not been left shrouded altogether in the darkness in which I found them.

Since writing the foregoing I got, on June 5th, five more specimens of *Lumpenus*, one of them, a female, carrying spawn, which would have been deposited within a fortnight or three weeks at latest. This brings my supposition relative to the time of spawning to be pretty nearly correct, viz. the end of July or beginning of August.

The longest specimen mentioned by Collett was 412 millim.; my longest one was  $12\frac{1}{2}$  inches.

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On the Anatomy of the Perignathic Girdle and of other Parts of the Test of *Discoidea cylindrica*, Lamarck, sp. By Prof. P. MARTIN DUNCAN, F.R.S., and W. PERCY SLADEN, F.G.S., Sec. L.S.

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*DISCOIDEA CYLINDRICA*, the *Galerites cylindricus* of Lamarck, is one of the commonest of the Echinoidea from the Upper Cretaceous strata; and its shape and internal casts in flint are familiar to all geologists. Desor, Wright, and Cotteau have described the species; and the last-named palæontologist has enlarged the generic diagnosis of *Discoidea* in consequence of some morphological details which had been elaborated by himself and some previous observers, especially E. Forbes and Lovén.

*Discoidea cylindrica* has five basal plates in its apical system, and the fifth or the posterior one is not perforated for a genital duct. But the palæontologists just mentioned found a perforated fifth basal in species which they felt bound to classify in the genus *Discoidea*. Lovén, speculating on this association of imperforate and perforate basals in different species of the same genus, considered it an instance of evolution during time. Cotteau extended the generic diagnosis, and added to that of Desor the following:—"Apical system compact, subpentagonal,